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Published in:
Proceedings of DRS2016

DOI:
10.21606/drs.2016.327

Publication date:
2016

DRS2016
Design + Research + Society
Future-Focused Thinking

2016 Design Research Society
50th Anniversary Conference
27-30 June 2016, Brighton, UK

Crafted with Care: Reflections from co-designing wearable technologies with care home residents

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Abstract: With increasing longevity and changes in population demographics; designers, engineers and architects are faced with the challenge of providing older adults with enabling technologies and home environments that facilitate physical activity and wellbeing. To promote acceptance and adoption, making these technologies more desirable and less stigmatizing is crucial. In this paper, we outline a craft-based co-design methodology that we developed working with groups of care home residents designing wearables for research. The research asks care home residents to wear activity-monitoring devices to provide insight into the ways they currently utilise their spaces and where improvements could be made. We propose that a craft-based approach allows designers to understand and uncover people's capabilities and needs in a non-intrusive and empathic way. Our findings show that using this approach enabled creativity, confidence and connectedness amongst participants. We discuss our reflections and insights that have implications on the approach and future work.

Keywords: Wearables; Ageing; Craft; Co-design

1. Introduction

The 'oldest old' are the fastest growing demographic in UK society. With increasing longevity, changes in our capabilities due to age or disease could cause us to lead less physically active lives. Research has shown that regular physical activity is an important measure of health and function in later life (Talbot et al., 2002). Unfortunately inactivity is particularly common amongst older people. Accelerometry data collected in England showed that only 6% of men and 4% of women over the age of 75 years reach current physical activity recommendations (NHS Information Centre for Health and Social Care, 2008). Furthermore, in care homes around Britain, 78% of men and 86% of women were classified as inactive. This is twice the number of people living in private homes according to

the British Heart Foundation (2014). Physical activity in older people can have many health benefits including fall prevention and mental wellbeing. Furthermore when physical activity increases in old age, physical abilities can be maintained or even improve (Fiatarone et al., 1994).

With ageing and the accompanying change in capabilities of older people, an increasingly important consideration is the emerging requirements for our built environments that meet the needs of the older population (McIntyre and Hanson 2013). Architects and designers alike face the challenge of creating enabling home environments that support the changing needs of users and promote independence for as long as possible. Successful design can make major contributions to maintaining or increasing physical independence for older adults and ensure that physical impairments are not a disability (Clarkson et al., 2003).

The context of this work is the BESiDE project which addresses challenges brought about by people living longer and the growing number of people spending significant time in residential care homes. The overarching aim of the research is to inform better building design that promotes greater mobility, physical activity and social connectedness and therefore wellbeing and better quality of life among care home residents. To achieve this aim body-worn location based and accelerometer technology is being used with local participating care homes to determine how well older adults living in care homes currently negotiate and utilise spaces within their built home environment.

Presently, little data is available on everyday physical activity for our oldest old or care home resident populations and self reported physical activity such as walking is known to be inaccurate (McMurdo et al., 2012). Whilst activity-monitoring devices can facilitate knowledge about movement, older wearers may perceive them to be ill fitting, unattractive, unfamiliar or associated negatively with “medical equipment” therefore inhibiting adoption. According to Turner and McGee-Lennon (2013) although the range of telecare technologies (which includes activity monitoring devices) that cater for a range of physical, health and social needs is increasing, the uptake for them is still low. Challenges that affect the uptake include the lack of consideration of different stakeholders, inappropriate functionality and interaction, not being able to personalise the technology as well as ethics and privacy issues.

To engage and include older people, not as subjects but active participants and stakeholders in the design of activity-monitoring devices or indeed any wearable technologies for health care, it is crucial to involve them in the early stages of design to gain insights that would shape products that are useful and appropriate for them. This is particularly important if we want the technology to benefit the wearers but also ensure that they adhere to wearing the technology so that the data collected is reliable for the researchers to analyse.

2. Related work

2.1 Wearables

With a focus on care home residents, various studies such as those by Hocking (1999) and Leger and McCaffery (2014) have suggested that between 50% and 56% of wearables and assistive technologies respectively are abandoned by older or vulnerable adults and 15% are never used. Furthermore, Ofcom (2015) conducted a survey revealing that no adults above the age of 65 years (sample size of 461) use wearable technology at home or anywhere else. Reluctance to adopt has been attributed to a lack of empathy between designers and users as many wearables are regarded as passive monitoring devices 'to keep you safe' and therefore viewed negatively by potential older users (Bryson, 2014).

Wearables have been researched and implemented in past health-related projects. For example SMART, which later became TARGET Stroke Exerciser after a merger with Philips Research, created wearable sensors with a focus of at home rehabilitation (Saini, 2008). Stroke patients wore a vest with sensors and an armband to link to a computing unit where patients could visualize their exercise progress on screen, compare with previous results and prepare future treatment plans. It was reported that by taking a user centred focus, the system successfully encouraged participating patients to engage more frequently in their home rehabilitation exercises although the wearables are bulky and may require additional aid to put on and take off. The vest and armband also look like medical apparatus. Whilst this may not be a negative factor in the context of home rehabilitation tools that are worn for a specific task for a short period of time during the day, an aesthetic such as this would not be apt for a care home study where residents will wear them for 5 days during waking hours, and should be unobtrusive and be worn easily in conjunction with resident's other clothing. Bodine and Gerperle (2003) in particular stressed that the acceptance of wearable devices depends on design for comfort and functionality and must be considered early in the design and development process. In particular their study found that there is an interplay of functionality, desirability and location of the device on the body. They stress that the functionality and benefits of the wearable need to be clear in order for acceptance and adoption of the technology. Where the technology is located on the body can play an important role in acceptability. Profita et al. (2013) did a study on the societal perceptions between Americans and South Koreans of six body locations (collarbone, torso, waist, forearm, wrist and pocket) for the placement of an e-textile input controller and found that culture plays a part where the preferred location should be. For example, the waist area for an American male and the collarbone and torso area for an American female are locations where the placement of a controller would be less acceptable. For South Koreans females, only waist and forearm areas are acceptable areas while South Korean males have no issues with any placement locations. Working with visually impaired people on wearables, Ye, Malu, Oh and Findlater (2014) found that mainstream designed small, easily accessible yet discreet (wrist, ring or necklace) wearable could positively impact its use as well as help facilitate in the participation of social interactions.

2.1 Designing with care homes residents

One important question is how do we co-design wearable technologies with older people in care homes. Although there are many methodologies reported by researchers working with older people in HCI such as Frohlich, Lim and Ahmed (2014) and Newell, Arnott, Carmichael and Morgan (2007), our literature review indicated only a few design studies (for example Blythe et al. 2010 and Gaver et al. 2011) and methodologies for working with care home residents. Our informal visits to participating care homes and meetings with staff and residents revealed the varied and significant cognitive and communication issues that may impede the resident group's engagement with the design and research; one carer suggested that "maybe 90%" of the residents suffered some degree of cognitive difficulty and may therefore struggle to understand the design intention. Staff should act as guides within the recruitment process to assess individuals' ability to participate. Other psychosocial effects that may affect older people in a workshop setting, for example, could include tiredness, lack of stamina, concentration, attention and motivation, slow responses and tendency to get sidetracked in conversation (Barrett et al., 2000; Newell et al., 2007). Several authors address these challenges by working with older partners in multiple stages over time (Demirbilek and Demirkan, 2004; Luck, 2007). It is important therefore to find innovative and user-centric ways to combat barriers in personalising technology. Barriers could include the lack of understanding of technology, which contributes to low levels of engagement particularly in the context of care home life as digital devices are often considered to be inappropriate or unnecessary (Dykes, 2013). Cognitive and generational issues may also further impede the understanding of technology in particular the effects of cognitive changes in aging and formative experiences by different birth cohorts with technologies that they have used could impact on the way older people understand and interact with current products (Lim, 2010).

As participants involved in the BESiDE project are required to wear activity-monitoring devices for several days, it is imperative that users are involved in the design of the carriers or wearables that house the activity-monitoring technology. Research by Norton, Mochon and Ariely (2011) has shown that people who are empowered to make their own objects or have a voice over the design tend to value them. Making and crafting have been part of people's lives and although it has been related to professions such as jewellery and metalsmithing, nowadays people have turned to crafting for recreational purposes. Rosner and Ryokai (2009, p195) describes that crafting is seen as a "partnership between people and technology for the creation of personally meaningful things". By empowering users to express their ideas and preferences and be involved in the designing of the wearable could potentially lead to better adoption and adherence of the technology and eventual study.

3. Methodology

Building on Szebeko and Tan's (2010) co-design methodology, we developed a progressive programme of design activities and materials to inspire, create and personalise wearables for the participating care home residents. Designed to encourage participation and

understanding of residents' needs and preferences, the activity programme comprised of initial informal visits with crafted samples, crafting activities and later, more structured design sessions.

3.1 Approach

Taking a craft approach, we devised a set of activities to engage residents with familiar materials and skills to design and personalise appropriate carriers for the sensor technology. In collaboration with staff, we tailored informal crafts activities sessions as well as more structured design sessions (co-design workshops) to suit the resident group (Figure 1). The informal craft sessions were hosted to enable staff, residents and researchers to get to know one another better and set the scene for the design activities. Informal craft activities typically last for two hours including tea breaks. We typically have 3 to 4 craft sessions introducing activities such as making fabric pictures and sessional cards. After the informal craft sessions, co-design activities were introduced to residents who were able and wanted to explore the development of wearables more fully and potentially take part in trialling the technology. At the start of the co-design sessions, the design process, methods, materials and example sensors were introduced and the brief explained to residents with the aid of a pictorial booklet. In addition, we created bespoke design tools including activity sheets, mood boards and a picture card deck of examples of wearable objects and fastenings to support residents in defining initial design requirements throughout the co-design process.

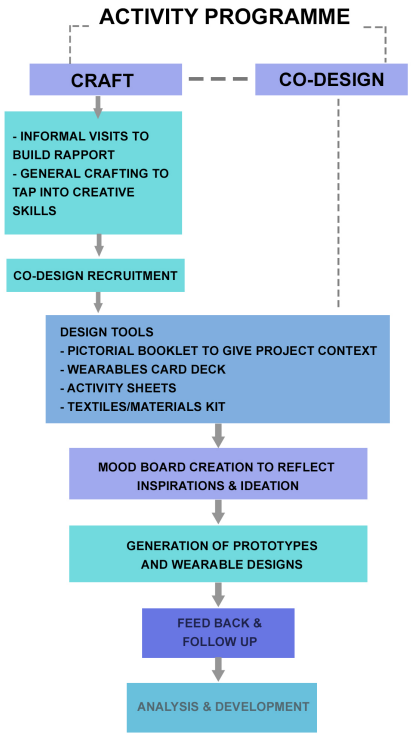

Figure 1. Progressive activity programme and use of project design tools.

These co-design activities were conducted over several weeks and depending on the participant's constitution, each session could last between 20 to 40 minutes. If any participants were unwell the sessions would be rescheduled or revisited with the resulting activity then taking place sometimes two to three weeks later. During the course of the project we also visited the residents informally, taking part in their in-house activities or have a chat with them over tea.

3.2 Materials

Everyday and familiar crafting materials (Figure 2) including buttons, yarns and textiles were used within the informal crafting sessions to explore aesthetic and textural preferences. Choosing from a sample set of textile swatches consisting of everyday, special occasion, athletic and health focused textiles, (e.g. polyester, silk, neoprene), a group of 6 older adults aged 65 and over with experience of care homes (for example as visitors or ex-staff) favoured cottons and wools as fabrics such as these are familiar and common within an older adults' everyday wardrobe and were therefore expected to be more readily accepted for incorporation into wearable designs.

Figure 2. Materials chosen for used in the informal crafting session were in response to consultation with older adults aged 65 and over who were staff, volunteers or have loved ones living in care homes.

These materials were used within the co-design sessions in conjunction with a range of design tools which included a body location card to explore ideal placement of potential wearables, a pictorial card deck showing examples of wearable objects and fastenings, (allowing us to explore possible styles and functionality), and activity sheets; "Getting to Know You", "In my Wardrobe", "My Textiles and Accessories" and "My Design Features" (allowing us to capture personality, values, and inspiration). The aim of using these tools was

to help residents' articulate their preferences and express their creativity. This culminated in the creation of personalised moodboards to visualise their design narratives. Reflecting on these also allowed residents to reflect on their developing design choices and rationale. (Figure 3).

Figure 3. Reflecting on design narratives using personalised mood boards.

3.3 Participants

14 participants (Table 1) aged 65 years and over were recruited from three participating care homes' resident groups. Identified as cognitively able to take part in the research by staff, residents were introduced to the research by way of informal visits and presentations where the researchers used picture cards and example wearables and craft materials to explain the context and intention of the research activity. Residents were invited to voluntarily take part in the research and making sessions. Residents who agree to participate were provided with participant information sheets at the beginning of each co-design activity as well as an informal briefing by the researchers to ensure clarity and understanding. Support was given as required by care home staff for example a staff member helped to relay our discussions to a partially deaf resident to ensure his understanding. Residents were assured that they could participate as little or as much as they felt able and happy to, with the option to opt out at any time. Informed consent was sought and obtained from all participants.

Table 1 Participant Profiles

Participant	Age	Gender	Marital Status	Occupation prior to retirement	Additional Health Factors
P01	84	F	Widowed	Housewife/farmer	N/A
P02	88	M	Widowed	-	Partially deaf/ Walking aid user
P03	94	M	Married (Living with spouse)	Royal Navy	Wheelchair/Walking aid user

P04	83	F	Married (Living with spouse)	-	Walking aid user
P05	74	F	Married	Admin at a media publishing company	Recovering from stroke
P06	79	F	-	Teacher	Visually impaired
P07	92	F	Widowed	Artist	Hard of hearing
P08	79	F	Widowed	Teacher	Aged related cognitive decline
P09	79	M	Married (Not living with spouse)	Civil Engineer	Mild cognitive impairment
P10	90	F	Widowed	Dance Teacher	Mild cognitive impairment

3.4 Analysis

During the crafting and co-design sessions, we were immersed in conversations and provided support for the activities we arranged. From observations and conversations, we took notes and photographs wherever appropriate. The documentation included informal notes, audio recordings of discussions and transcriptions, worksheets and photos of craft materials. Through sharing these notes, study of photos and worksheets and in-depth discussions among researchers a numbers of themes emerged under which we report our findings and inform our discussions.

4. Findings

4.1 Crafting

The aim of the informal craft sessions were to build trust with residents, families and staff; getting to know the needs, likes and dislikes of residents whilst crafting. Residents created soft textile artefacts on a drop in and out basis, experimenting with a range of different coloured, textured and patterned materials (Figure 4). We visited frequently and demonstrated the value of residents' participation by giving personalised thank you cards for taking part and supported them in 'exhibiting' their creations informally in the care homes.

Sorting through the materials with residents articulating their choices allowed the researchers an understanding of their preferences in terms of aesthetics and tactility. During these activities, residents were also prompted to share more detailed stories about their lives; one resident shared with us, her experience of working in a textile factory making clothing upon finding materials similar to the colours of felt she had worked with. Discussing everything from where they grew up, family, travel, work and hobbies, this kind of rich information gave us an understanding of residents' life stories and informs us, as designers, of the wider issues pertaining to their design choices.

Figure 4. Residents experimented with combinations of textiles and accessories to create their designs.

As well as encouraging storytelling, these activities can inspire new connections and conversations as one carer commented that, 'it is exciting to observe the various benefits that design and craft activities can have for this population' as two residents worked together having not spoken before. Furthermore, an informal Christmas crafting event hosted by the researchers to engage new residents with the project saw participants create soft decorations or Christmas cards around a table in the main lounge. This collaborative activity encouraged residents to be 'hands on' with making their design choices and to comment upon and encourage one another's design direction (Figure 5).

Figure 5. Residents create and discuss Christmas decorations and cards.

4.2 Co-designing wearables

The rapport created during the crafting session encouraged residents' to be open about discussing the technology our team planned to use to track physical activity and location, which was a Samsung Galaxy S3 mini phone. Most residents pointed out that they do not

carry wallets or handbags and in certain cases for the women, they may wear garments that do not have pockets. All the residents were also not keen on the size and weight of the phone. After explaining our project through the pictorial booklet we designed, ten residents expressed an interest in the project and participated further in the co-design workshops. During the co-design workshops we chatted, created and critiqued possible wearable design solutions that would hold the device and fit with their existing garments and lifestyle during and after the study.

The residents' design journeys were given context through the use of the various bespoke design tools. Residents made quick and decisive choices about their preferences for potential future wearables by sorting through the pictorial cards (Figure 6). The task is familiar and game-like, as residents build collections of cards to communicate the styles they like and dislike. Using the activity sheets, residents described their lives by detailing hobbies, likes, dislikes and their personal taste (Figure 7). Capturing this information on paper enabled residents to hone into specific themes for exploration within their design process. For example, one resident who shared stories about her career as a dancer and teacher took inspiration from the colours, patterns and textures of the dance costumes she had worn in her younger years (Figure 8). The personalised mood boards – which featured drawings, photographs, patterns, colours and motifs that are representative of the topics of interest that residents have shared - were useful tools in providing residents with a visual snap shot of their design development and in prompting and focusing conversation as residents 'see' part of themselves and their experience of the design process in the mood board.

Figure 6. Residents sort cards from the wearables card deck as inspiration.

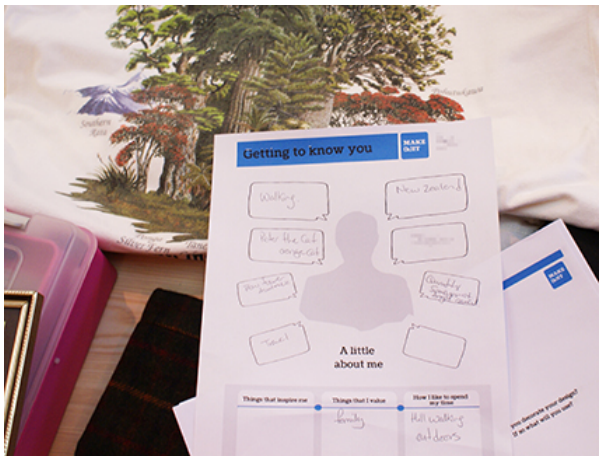

Figure 7. Simple worksheets are used to gather information and inspirations unobtrusively.

Figure 8. Personalised mood boards define design direction and inform the aesthetic of residents' wearable designs.

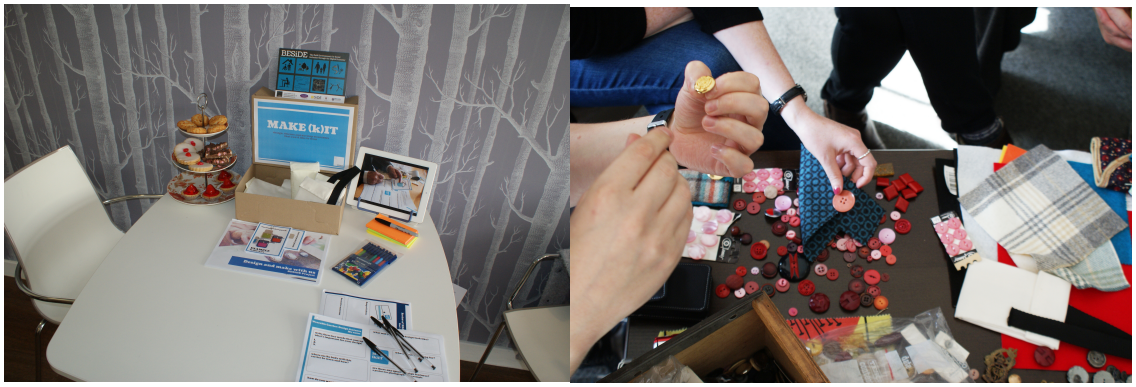

Figure 9. Make-(K)It and materials

These tools, which we eventually collated into a 'make-kit' (Figure 9), is useful in building a picture of individual residents' likes, influences and inspirations, which eventually contribute to the appearance, 'feel' and function of their designs. These tools are used responsively as and when they are needed by the researchers to support the participating residents as they move through each stage of design development. The activities resulted in the creation of

personalised soft carrier prototypes that could be further customised or manipulated to illustrate and explore 'ways to wear'.

4.3 Participant Feedback

After completion of the activities and participants given the carriers, we visited the participants and staff for a feedback session. Feedback was gathered using a combination of informal interviews and feedback sheets. Of the ten residents who participated in the co-design workshops, five residents (2 male and 3 female) and 2 staff members (activity coordinator and care home manager) took part in the feedback. As for the other five who did not participate, one resident was hospitalised and the other four were feeling poorly. In general the feedback were positive as one participant remarked: "*I enjoyed the craft activities, the board that was made for me showing the time I was working in Timex and the area I lived in especially visiting the dancing hall, I hung up in my room. I enjoyed being able to suggest ideas, the Hilltown clock tower on the badge I liked that", (P05).* For some it is more about the company: "*I really enjoyed both of you coming in, for making my day, especially the Forfar Bridie", (P01).* Both staff members commented that the residents enjoyed the activities and the company. The home manager added that she would be looking to introduce and incorporate arts and craft in the resident's weekly activities.

5. Discussion

5.1 Craft: Enabling and facilitating understanding and agency

While expressing their creativity during craft activities, participants often related stories, giving the researchers insight into the context of their creations. Indeed engaging residents in craft and shared making activity can create open spaces for non-linear conversation and storytelling which in turn provide rich insights that can inform the design of prototypes and anticipate future scenarios of use. One resident, whilst sorting through a set of tartan swatches, told of his time in the Royal Navy and happening upon his regiment's tartan, he expressed that he would feel a great sense of pride to wear his tartan again (Figure 10). This resident understood that he himself may not benefit directly from any resulting changes to the care home environment as a result of the data gathered from the activity logging devices but told us that he would like to participate in support of future care home residents and if he could do so by also fashioning a wearable harking back to his time in the RN with his regiment then he would be pleased to do so. He also added that: *"It would give me an excuse to tell stories from that time in my life" (P03).* This understanding enables designers to comprehend more acutely the issues, needs and concerns of users regarding the role of wearable technologies that the project hope to introduce into their lives. For the participant it was more about identity and connecting with others and using the wearable as an opportunity to share about his life with others.

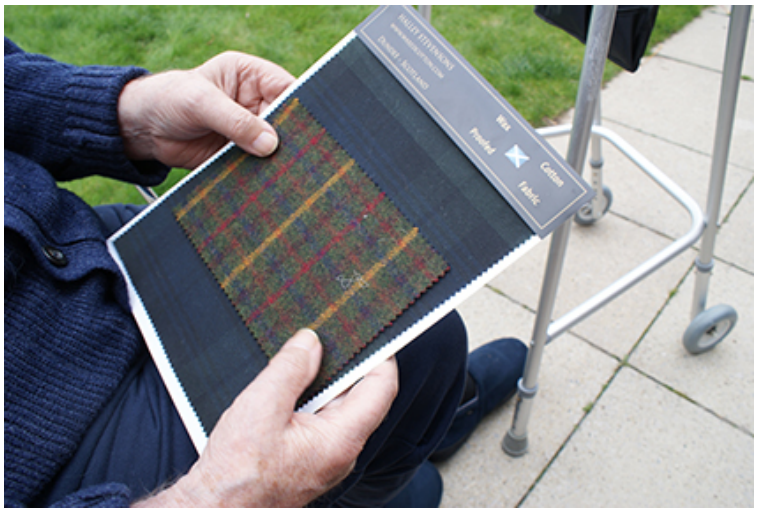

Figure 10. A resident reflects on his time in the Royal Navy in choosing his regiments' tartan for his design.

Engaging residents in a craft rather than technology focused process with soft and familiar materials – such as everyday fabrics, buttons and badges – was also useful in opening up discussion regarding technologies. This breaks down barriers for engagement for those who are not 'tech savvy'. When confronted with examples of current wearable tech, residents told us "I don't need gadgets" *(P04)* or "I would have to learn how to use it first" *(P09)*. In contrast, by creating personalised pouches or carriers which first describe visually an aspect of the wearer – their personality, skills or likes – and secondarily hold sensors, residents were able to design objects that would easily fit around their lives and everyday routines, breaking down some barriers to their perceptions of technology. This process also encouraged their confidence in asking questions and imagining how technology might be apply to their home environment.

Using this crafting approach together with the design tools that acted as visual prompts, allowed a range of insights and latent needs to be revealed that may not have been uncovered otherwise. The participants, with some support, were quite quickly able to define initial design requirements to suit their unique needs in terms of fit, comfort, style, acceptability and expectation. The residents displayed the mood boards and prototypes we created for them in their rooms and they were keen to show them off to each other as well as staff and family members.

Though these tools and materials were designed and chosen specifically to engage with and inspire residents in creating personalised wearables, their true value and potential was not observed until the live making sessions; First, the card deck set the scene for the research, inviting participants to question, discuss and ideate around the topic of wearables; Secondly, the activity sheets drew out personal experiences or potential influences to inform the design narrative in their own wearables; Finally, the textiles, craft materials and collaged mood boards engaged residents in the aesthetics and tactility of their design and gave form to their wearable. In using these tools at these specific junctures within the design timeline,

residents were able to co-design crafted wearables in response to their own personal taste and practical needs.

5.2 Empathy, Mutuality & Reciprocity: Building Trust

Key to the development of positive relationships between the researchers, residents, staff and visitors is empathy and mutuality. According to Wright and McCarthy (2008) three qualities needed for empathic design are (i) a quality relationship between the designer and user to allow the designer to be attuned to the user's needs; (ii) a sympathetic disposition towards the other person; and (iii) an attention to the affective and emotional quality of their experiences. Through our craft and co-design approach, we developed a good relationship with our participants and were responsive to their needs and experiences. Residents need relationship reciprocity (Dee and Hanson 2014) to establish trust before imparting their knowledge and personal stories. We invested time to better understand their experiences starting from the initial introduction stage by chatting over a cup of tea and participating in in-house activities such as bowls with them. By immersing ourselves in their hobbies, daily activities and conversations, we gained residents' confidence and developed rapport. This in turn encouraged their interest and assurance in the design activities. It is also important to acknowledge that trust allows participants to feel comfortable in speaking their mind about what they want and not be overly positive or swayed by a designer's suggestion.

One interesting contradiction in this project is between the inclusion of and crafting with participants, and the actual activity monitoring purpose of the final design. On one hand we encourage personalisation, agency and empowerment via co-design but on the other hand the end product (i.e. monitoring device) is not facilitating any of this. We were honest with the residents, letting them know what the project was about from the onset. We explained to them the aim of the project and it is for the future betterment of care homes. Although those who agreed to participate did so out of altruism, it is important that we treat our participants with dignity, and one in which the device they would eventually carry should not stigmatize them. We acknowledged the diversity of capabilities and needs of the residents and that the solution needs to fit into the person's lifestyle and as such adopted an approach where empathy and mutuality is valued.

5.3 Flexibility and being responsive to residents needs

Care homes are busy environments prone to change and there are constant distractions caused by other activities such as daily tasks, housekeeping, visitors that may hamper research activity. It is essential to be flexible and agile in our approach whilst working in changeable settings such as this. Participants may have 'good days' and bad as well as being subject to surprise visits from friends and family; researchers must be respectful and responsive to these situations, gauging opportune moments for creation and design, or indeed appreciate when to press pause and resume the research activity at a more appropriate time.

6. Conclusion and future work

We introduced and showed how using a craft-based co-design approach helps to engage older people who may not be open to new technologies such as wearable devices. This is important especially when older people who belong to a different generation might not see technological devices as part of their everyday accoutrement. Shifting the focus from technology to craft can break down barriers for engagement for those who are not 'tech savvy'. Through craft, we were able to draw out residents' stories and concerns over shared activity. The group making activities also created a relaxed atmosphere, encouraging conversation to flow in a non-linear, open way from which rich insights can then be made to inform the design of wearbles. We revealed that crafting uncovered not only material preferences but also enabled creativity and increased confidence, agency and connectedness for participants. To develop a successful co-design session we recommend the building of trust, mutuality and reciprocity. This allows the building of relationships and partnership allowing participants to be open and feel assured of their feedback. However empathy, trust, mutuality and reciprocity does not happen instantaneously and requires an investment of time and effort. We also highlighted the need to be flexible, respectful and responsive when working in the context of care homes where activities may not always go according to plan. To develop acceptable wearables that care home residents would want to wear beyond research or buy for themselves because they find it genuinely useful, the needs, experience and desires of these potential users need to be considered. As such, a bespoke and intensive approach is expected mainly because of the demographic we are designing with experiences some form of physical or cognitive deterioration and this requires time, sensitivity and flexibility build into the design process.

With research involving people and the gathering of data, there is generally a focus on pre-built, ready to wear wearable devices. The user or participant of a study is usually given the device, and participants - if they agree to the study - just have to 'get on with it' (unless they withdraw from the study). Our co-design and craft approach and 'make-kit' may prove useful in future research activity with care home residents where personalisation of technology is involved. Although negative about the attributes of the device initially, the residents who co-designed with us reframed their view where the wearable through craft, became a reflection of their identity, personality and preferences and also potentially act as a conversation starter. By allowing older adults to have a voice in the process, this might lead to better adoption and adherence rate not just for a research study where the outcome might not benefit the users immediately but for any telecare or healthcare devices used at home or in social care. With the rise of the DIY and maker movement, users in the future could either work with designers and/or technologist, or by themselves be provided with options or a kit to personalise their own health technologies.

Acknowledgements: BESiDE (The Built Environment for Social Inclusion in the Digital Economy) project was supported by the RCUK Lifelong Health and Wellbeing Programme grant number EP/K037293/1.

7. References

Barrett, J., & Kirk, S. (2000) Running focus groups with elderly and disabled elderly participants, *Applied Ergonomics*, *31*, pp 621-629.

Blythe, M., Wright, P., Bowers, J., Boucher, A., Jarvis, N., Reynolds, P., and Gaver, B. (2010) Age and experience: ludic engagement in a residential care setting, *Proc. DIS'10,* pp. 161-170.

Bodine, K., and Gemperle, F. (2003) Effects of functionality on perceived comfort of wearables, *Proc. ISWC'03*, pp. 57-60.

British Heart Foundation National Centre (2014) *Current level of physical activity in older adults*, http://www.bhfactive.org.uk/files/1171/Physical%20Activity%20Older%20Adults%20AW.pdf. (Accessed 12 Nov, 2015)

Bryson, D. (2014) The adoption and nonadoption of new technologies by the active ageing, in McCann, J. and Bryson, D. (eds.), *Textile-led design for the active ageing population*, Woodhead Publishing, pp. 47-58.

Clarkson, J., Coleman, R., Keates, S., and Lebbon, C. (2003) *Inclusive Design: Design for the whole population*, Springer-Verlag London.

Dee, M., and Hanson, V. (2014). A large user pool for accessibility research with representative users, *Proc. Assets'14*, pp. 35-42.

Demirbilek, O., & Demirkan, H. (2004) Universal product design involving elderly users: A participatory design model. *Applied Ergonomics*, *35*,*4*, pp 361-370.

Fiatarone, M.A., O'Neill E.F., Ryan, N.D., Clements, K.M., Solares, G.R., Nelson, M.E., Roberts, S.B., Kehayias, J.J., Lipsitz, L.A., & Evans, W.J. (1994) Exercise training and nutritional supplementation for physical frailty in very elderly people. *N Engl J Med*, *330,25*, pp 1769-1775.

Frohlich, D.M., Lim, C.S.C., & Ahmed, A. (2014) Keep, lose, change: Prompts for the re-design of product concepts in a focus group setting. *CoDesign*, *10,2*, pp 80-95.

Gaver, W., Boucher, A., Bowers, J., Blythe, M., Jarvis, N., Cameron, D., Kerridge, T., Wilkie, A., Philips, R., and Wright, P. (2011) The photostroller: supporting diverse care home residents in engaging with the world. *Proc. CHI'11*, pp. 1757-1766.

Hocking, C. (1998) Function or feelings: factors in abandonment of assistive devices. *Technology and Disability*, *11*, pp 3-11.

Ledger, D., and McCaffrey, D. (2014) *Inside Wearables: How the science of human behaviour change offers the secret to long-term engagement*. http://endeavourpartners.net/assets/Wearables-and-the-Science-of-Human-Behavior-Change-EP4.pdf (Accessed 16 Nov, 2015)

Luck, R. (2007) Learning to talk to users in participatory design situations. *Design Studies* , *28*, *3*, pp 217-242.

McIntyre, L., and Hanson, V. L. (2013*)* BESiDE – The Built Environment for Social Inclusion in the Digital Economy. *CHI '13 Extended Abstracts on Human Factors in Computing Systems*. New York, USA, ACM, pp. 289-294.

McMurdo M.E.T., Argo, I., Crombie, I.K., Feng, Z., Sniehotta, F.F., Vadiveloo, T., Witham, M.D., & Donnan, P.T. (2012) Social, Environmental and Psychological Factors Associated with Objective Physical Activity Levels in the Over 65s. *PLoS ONE, 7*, *2*, e31878.

Newell, A., Arnott, J., Carmichael, A., and Morgan, M. (2007) Methodologies for Involving Older Adults in the Design Process. *Proc. HCII 2007 (5)*, Springer, Heidelbreg, pp. 982-989.

NHS Information Centre for Health and Social Care (2009) *Health Survey for England 2008: Physical Activity and Fitness*. London: NHS Information Centre for Health and Social Care.

Norton, M., Mochon, D., & Ariely, D. (2011) The IKEA Effect: When labor leads to love. *Journal of Consumer Psychology*, *22*,*3*, pp 452-460.

Profita, H., Clawson, J., Gilliland, S., Zeagler, C., Starner, T., Budd, J., and Do, E. (2013) Don't mind me touching my wrist: a case study of interacting with on-body technology in public. *Proc. ISWC'13*, pp. 89-96.

Rosner, D.K., and Ryokali, K. (2009) Reflections on craft: probing the creative process of everyday knitters. *Proceedings of the C&C'09*, California, USA, ACM, pp. 195-204

Saini, P., Willman, R., Huurneman, R., Lanfermann, G., Vrugt, J., Winter, S., and Buurke, J. (2008) Philips stroke rehabilitation exerciser: a usability test. *Proceedings of the IASTED International Conference on Telehealth/Assistive Technologies*, CA, USA, ACTA Press Anaheim, pp. 116-122.

Talbot, L.A., Morrell, C.H., Metter, E.J., & Fleg, J.L. (2002) Comparison of cardiorespiratory fitness versus leisure time physical activity as predictors of coronary events in men aged ≤ 65 years and > 65 years. *Am J Cardiol*, *89*, pp 1187–92.

Vines, J., Blythe, M., Dunphy, P., Vlachokyriakos, V., Teece, I., Monk, A., and Olivier,P. (2012) Cheque Mates: Participatory Design of Digital Payments with Eighty Somethings. *Proc. CHI'12*, pp. 1189-1198.

Wright, P. & McCarthy, J. (2008). Empathy and experience in HCI. *Proc. CHI '08*, pp. 637-646.

Ye, H., Meethu, M., Oh, U., and Findlater, L. (2014) Current and Future Mobile and Wearable Device Use by People With Visual Impairments. *Proc. CHI'14,* pp. 1189-1198.

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